

Claims

1. A protein complex comprising at least two, preferably identical, subunits wherein at least one subunit is unaltered and at least one subunit is fused to a first molecule of interest and wherein the protein complex is able to interact with a cell surface receptor via said subunits.  
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2. A protein complex according to claim 1, wherein said first molecule of interest can associate with, preferably via a covalent bond, a second molecule of interest to form a multimer of interest.  
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3. A protein complex according to claim 1 or 2, wherein said complex is essentially based on the heat labile enterotoxin (LT) of *E. coli* or on the cholera toxin (CT) of *Vibrio cholerae*, preferably the B subunits thereof.  
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4. A protein complex according to any of the preceding claims, wherein said complex comprises at least two subunits provided with a molecule of interest.
5. A protein complex according to claim 4, wherein said at least two subunits are provided with a different molecule of interest.  
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6. A protein complex according to any one of the preceding claims, wherein said cell surface receptor is present on intestinal epithelial.
- 25 7. A protein complex according to any one of the preceding claims, wherein at least one molecule of interest is an antigen.
8. A protein complex according to claim 7, wherein said antigen is selected from the group consisting of a bacterial antigen, a viral antigen, a protozoal antigen and a fungal antigen.  
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9. A protein complex according to any one of claims 1 to 6, wherein at least one molecule of interest is an immunomodulatory protein, preferably a cytokine or a heat-shock protein.  
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10. A protein complex according to any one of the preceding claims, wherein said complex comprises five B subunits of the heat labile enterotoxin (LT) of *E. coli* or the cholera toxin (CT) of *Vibrio cholerae*, wherein at one subunit is unaltered.

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11. A protein complex according to any one of the preceding claims, wherein said cell surface receptor comprises a ganglioside molecule, preferably GM1, or a mimic thereof.

10 12. A method for producing a protein complex according to any one of claims 1-11, comprising:

- a) providing a host cell with a nucleotide sequence encoding an unaltered subunit and a nucleotide sequence encoding a molecule of interest, wherein at least one molecule of interest is fused to a subunit;
- 15 b) culturing said host cell thereby allowing expression of said nucleotide sequences and allowing for assembly of the protein complex;
- c) isolating the complex;
- d) determining the binding of the complex to a cell surface receptor or to a molecule which mimics a cell surface receptor.

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13. A method for producing a protein complex according to any one of claims 1-11, comprising:

- a) providing a first host cell with a nucleotide sequence encoding an unaltered subunit and a second host cell a nucleotide sequence encoding a molecule of interest, wherein at least one molecule of interest is fused to a subunit;
- 25 b) culturing said host cells thereby allowing expression of said nucleotide sequences;
- c) isolating the proteins encoded by said nucleotides;
- d) contacting the isolated protein under conditions allowing for assembly of the protein complex;
- 30 e) isolating the complex;
- f) determining the binding of the complex to a cell surface receptor or to a molecule which mimics a cell surface receptor.

14. A method according to claim 13, wherein said host cell is provided with said nucleotide sequences using transformation, co-transformation, crossing, re-transformation or transient transfection.

5 15. A cell comprising the protein complex according to any one of claims 1 to 11.

16. A cell according to claim 15, wherein said cell is a plant cell.

10 17. A cell according to claim 15 or 16, wherein said cell is an edible cell.

18. A composition comprising a protein complex according to any one of claims 1-11 or a cell according to any one of claims 15-17.

15 19. A vaccine comprising a protein complex according to any one of claims 1-10 or a cell according to any one of claims 15-17 and a pharmaceutically acceptable carrier.

20. A pharmaceutical composition comprising an effective amount of a vaccine according to claim 19.

21. Use of a protein complex according to any one of claims 1-11 as a mucosal carrier molecule.

25 22. A method for modulating an immune response of a subject comprising administering to the subject at least one dose of an effective amount of a protein complex according to any one of claims 1-11, wherein the molecule of interest is an antigen.

30 23. A method for mucosal immunisation comprising the administration of a vaccine according to claim 19 to a subject.